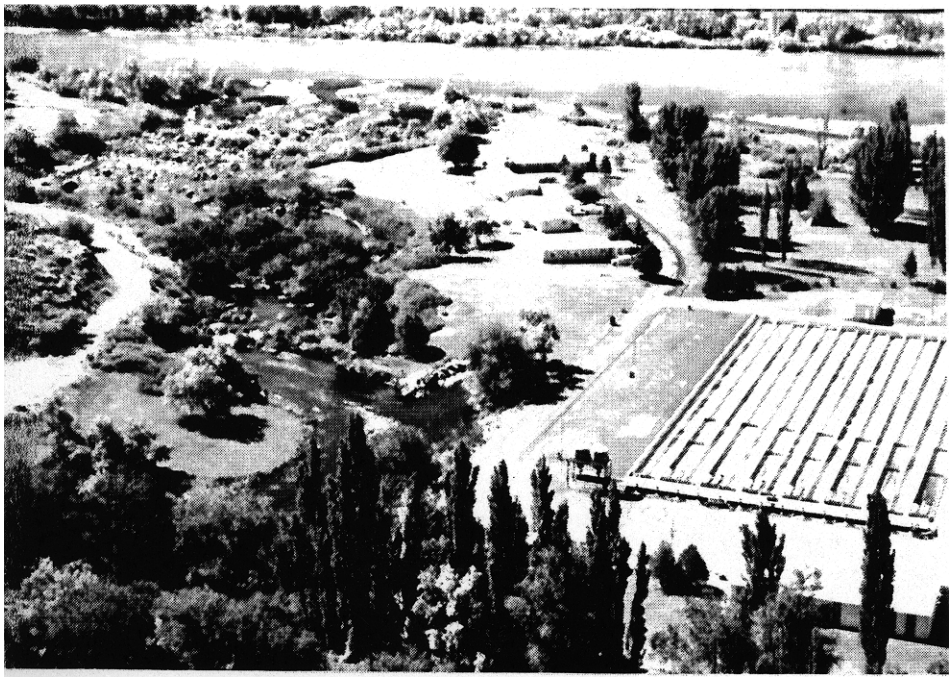
NIAGARA SPRINGS FISH HATCHERY

2000 Steelhead Brood Year Report



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August 2001
IDFG 01-25

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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,462,267 steelhead *Oncorhynchus mykiss* eggs and fry during the 2000 brood year. A total of 1,416,442 Pahsimeroi strain eggs and fry (758,656 eggs and 657,786 swim-up fry) were received from Pahsimeroi and Oxbow hatcheries. Pahsimeroi strain eggs were shipped from Oxbow Hatchery to NSFH as eyed eggs while the Pahsimeroi strain fry were incubated at the Oxbow facility then shipped to NSFH as first feeding fry. A total of 1,045,825 Oxbow strain eggs and fry (527,641 eggs and 518,184 swim-up fry) were received directly from Oxbow Hatchery.

Total production for the 2000 brood year at NSFH was 2,361,937 steelhead (459,580 lbs), which included both surplus fish and anadromous smolt releases. Excess fish were stocked as fingerlings.

A total of 431,133 excess steelhead fingerlings (9,850 lbs at 43.8 fish/lb) were released into Cascade, Paddock, Salmon Falls, Mormon and Magic reservoirs between October 16 and November 1, 2000. These stockings took place after fin clipping was concluded and final production numbers were determined.

A total of 1,930,804 steelhead smolts (449,730 lbs at 4.29 fish/lb) were released into the Snake and Salmon rivers from March 26 to May 9, 2001. A total of 889,955 smolts (219,230 lbs at 4.06 fish/lb) of Pahsimeroi strain were released in the Pahsimeroi River at the weir, and 194,303 smolts (46,750 lbs at 4.16 fish/lb) of Pahsimeroi stock were released in the Little Salmon River at Stinky Springs. A total of 579,467 smolts (124,550 lbs at 4.65 fish/lb) of Oxbow stock were released in the Snake River at Hells Canyon Dam, and 267,079 smolts (59,200 lbs at 4.51 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River at Stinky Springs.

Mortalities from pathogens were well below normal this year. All steelhead were vaccinated for furunculosis, *Aeromonas salmonicida.* Steelhead at NSFH were not vaccinated for enteric redmouth disease, *Yersinia ruckerii,* during this brood year. Furunculosis, ERM, or IHNV were not isolated during the 2000 brood year. Coldwater disease, *Flavobacter psychrophilum*, and *Aeromonas hydrophila* caused minor mortality just prior to release.

A total of 473,540 lbs of fish feed was fed (462,540 lbs of Rangen and 11,000 lbs of Moore-Clark) at a cost of $152,953.42 to produce 459,580 lbs of steelhead for a conversion rate of 1.03:1.

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INTRODUCTION

The Niagara Springs Fish Hatchery (NSFH) is owned and financed by Idaho Power Company (IPC), and operated and staffed by the Idaho Department of Fish and Game (Department). It is located in the Snake River Canyon, ten miles south of Wendell, Idaho. The NSFH is one of four hatcheries IPC owns and which the Department staffs and operates that fulfill IPCs mitigation requirement under the Federal Energy Regulatory Commission (FERC) license #1971. The goal of NSFH is to rear 400,000 pounds (lbs) of steelhead *Oncorhynchus mykiss* smolts annually. Originally, these smolts were used to relocate a portion of the Snake River steelhead run into the Salmon River. Since 1980, 200,000 lbs of production are used to sustain a steelhead run below Hells Canyon Dam in the Snake River, and 200,000 lbs are stocked in the Salmon River.

OBJECTIVES

The two major mitigation requirements that must be met at IPCs NSFH are to produce quality steelhead smolts to sustain steelhead trout runs in the Snake River below Hells Canyon Dam and in the Salmon River and its tributaries by successfully meeting these objectives:

1. Rear 200,000 lbs of quality steelhead smolts to be released in the Salmon River and its tributaries. The steelhead are to return as adults in sufficient numbers to provide quality sport fisheries in these waters and to supply sufficient broodstock (1,000 adults) to the Pahsimeroi Fish Hatchery for the collection of spawn for the next production cycle.

2. Rear 200,000 lbs of quality steelhead smolts to be released in the Snake River below Hells Canyon Dam. These are to return as adults in sufficient numbers to provide a quality sport fishery in the Snake River and to supply sufficient broodstock (1,000 adults) to the Hells Canyon Trap for the collection of spawn for the next production cycle.

IDAHO DEPARTMENT OF FISH AND GAME GOALS

1. Provide quality steelhead smolts to the Snake and Salmon rivers that will survive downstream migration and return as adults in sufficient numbers to provide a quality sport fishery in these waters and their tributaries.

2. Provide quality hatchery steelhead for supplementation where wild stocks of steelhead have diminished below desired levels and where managers feel quality hatchery steelhead would enhance the fisheries resource.

3. Enhance the genetic quality of hatchery stocks through management and hatchery practices that favor genetic variability and the wild genetic component.

FACILITY DESCRIPTION

The NSFH facility consists of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. Spring water supplies 21 upwelling incubators and 21 sixty-cubic-foot (cf), rectangular vats for the hatching and early rearing of fry. The incubators and nursery tanks provide 1,260 cf of hatching and early rearing space.

The outdoor rearing space consists of nineteen (300-ft x 10-ft), (142,500 cf) raceways, which are supplied by constant temperature, gravity flow, spring water. This allows for the production of 400,000 lbs of steelhead at a density index of less than the recommended 0.35 lbs/cuft/in (Piper 1982). In addition, the odd-numbered raceways are divided in the upper sections into two (4.5-ft x 20-ft) raceways (3,440 cf) for fry and fingerling rearing.

Two flow-through settling ponds (150-ft x 60-ft) are provided to remove settleable solids from the NSFH effluent. The settling ponds handle all the flow from the raceways and meet Environmental Protection Act (EPA) guidelines for aquaculture discharge. In addition, dissolved nutrients are monitored on a biweekly basis to comply with the terms of a consent order with the Idaho Division of Environmental Quality (IDEQ). Water samples are collected by Sigma water samplers and sent to Rangen Aquaculture Research Center for analysis.

The NSFH feeding system is completely automated. Two moveable bridges span the rearing area. A total of 19 Nielsen automatic feeders are mounted on the bridges. The fish are fed by moving the bridges down the length of the rearing area and energizing the individual feeders on the control panels. Bulk feed is dispensed to the feeders by a conveyor supplied by two 20,000-lb storage bins with an associated fines separator. Ziegler belt feeders are used to deliver feed to fry in nursery areas.

Raceway cleaning is also automated with an air blower system. Three blower motors supply approximately 10 psi to weighted, perforated, airlines on the bottom side corner of each raceway. The resulting bubble screen creates a vortex of water currents that keep waste material suspended along the length of the raceways. This system saves many hours of labor sweeping raceways.

Buildings on the NSFH grounds include five residences. Three are wood-frame houses, one is a doublewide modular home, and one is a 14-ft wide mobile home. A 32-ft x 80-ft metal building contains an office, two incubator rooms, garage, shop, and feed storage room. Also on the grounds are one storage building (10-ft x 30-ft), a cinder block chiller building (70-ft x 45-ft) which contains the chiller and blower-electrical room, a heated shop, and garage. The NSFH staff is also responsible for care of the IPC-owned two-acre park adjacent to Niagara Springs Creek. It has a public, handicapped-accessible restroom, picnic tables, and refuse containers.

WATER SUPPLY

In addition to NSFH, Niagara Springs supplies water to Rim View Trout Company, Niagara Springs Wildlife Management Area, and Idaho State's Pugmire Park. Niagara Springs total flow is 220 cubic feet per second (cfs), which is divided into water rights by the four users.

The IPC has entered into an agreement with the four other users of Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). The NSFH has a water right of 132 cfs.

Water from Niagara Springs is a constant 59°F and flows by gravity to the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Water quality is checked on a yearly basis at the NSFH (Appendix 2).

STAFFING

Four permanent and two temporary personnel staff the NSFH. Jerry Chapman, Fish Hatchery Manager II, and Michael Graham, Fish Hatchery Assistant Manager handle the NSFH supervision. There are two Fish Culturists, Paul Dorman and Brian Thompson, to handle most operational duties. During peak work activities there are three Bio Aides: Abe Koehler, Gene Waltz and Mike Anderson, who assist the permanent staff with culture, maintenance, and other assignments.

FISH PRODUCTION

Egg Shipments and Early Rearing

The NSFH received both eggs and fry for the 2000 brood year (Appendix 3). To retard embryonic development, all steelhead eggs were incubated in chilled wellwater (43°F) at Oxbow Hatchery prior to transfer to NSFH. This procedure was done to control smolt size while minimizing the need to take fish off feed during the rearing cycle. At the Oxbow Hatchery a 70 horsepower chiller unit was utilized to chill 52°F wellwater to 43°F for incubation. Pahsimeroi Hatchery does not have a chiller unit for this purpose; consequently, eyed steelhead eggs were shipped directly to NSFH and those Pahsimeroi eggs destined as fry were incubated at Oxbow and then shipped as first feeding fry to NSFH. Fry were transported in specially designed, perforated, fry transport tubes that were floated inside of a 2-ton fish truck furnished by Hagerman State Fish Hatchery (HSFH). No Pahsimeroi stock eggs were incubated at Sawtooth Hatchery during this brood year.

The NSFH received 758,656 eyed-eggs of Pahsimeroi stock between May 11 and June 13, 2000 (Appendix 3). A total of 657,786 Pahsimeroi stock swim-up fry from egg lots 7 through 13 were shipped to NSFH this year.

A total of 527,641 eyed-eggs of Oxbow stock (lots 6-11) were shipped to NSFH from May 23 through June 2, 2000. Early lots (1-5) were transported to NSFH as swim-up fry (518,184) between June 30 and July 7, 2000, and placed directly into outdoor nursery raceways. The timing of the fry shipments coincided with the swim-up timing of fish from the eyed-eggs that were received earlier at NSFH. The HSFH furnished the truck used for transportation for these fry as well.

Upon arrival at NSFH, all eggs were tempered and disinfected with iodine at 100-ppm for 30 minutes and placed in upwelling incubators (42,500 per incubator) inside the vats. All fry were tempered in their shipping containers before ponding.

Fry were not inventoried from the nursery vats to the nursery raceways this brood year. Consequently, hatching success and mortality could only be estimated. The NSFH staff observed below-normal losses due to suffocation during the early rearing cycle. Survival of fry to fingerling was 96.29% in Pahsimeroi steelhead and 98.14% in Oxbow steelhead. Overall, fry to fingerling survival was 97.22%. This year the nursery sections were screened at both ends and expanded from 20-ft to 35-ft in length. This prevented fry and fingerlings from getting into the headrace, and allowed the fry to be reared at lower starting densities. As densities increased, fry were given more rearing volume by relocating screens to 50-ft and finally to the end of the first section at 100-ft.

Throughout the entire early rearing production, steelhead at NSFH were fed Rangen's dry feeds. Feed was dispensed with Ziegler belt feeders and supplemented with hand feeding in the indoor and outdoor nursery areas. When the fingerlings reached approximately 250 fish/lb they were fed Moore-Clark's Nutra Fry (ProActive) dry feeds for 14 days. The purpose of feeding Moore-Clark's ProActive feed was to stimulate the fry's immune system prior to the vaccination program.

When they reached 75 fish/lb, all NSFH fish were switched to a Rangen extruded diet. The switch to Rangen bulk extruded feed allowed NSFH staff to utilize the bulk tanks, feed conveyor system, fines separator, and bridge feeders.

Final Production Rearing

Fin-clipping operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 100-ft section of each odd-numbered raceway. Half the fish are clipped and put into the upper two-thirds of the raceway, while the other half are clipped into the adjacent even-numbered raceway. Fin-clipping operations started on October 2 and were completed by October 26, 2000.

Fish were given the final 100-ft of rearing space in December. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 through 19. Normal fish culture techniques include: feeding fish with the bridge, sweeping raceways, conducting sample counts, cleaning screens and air lines, removing mortalities, equipment maintenance, record keeping, nutrient sampling, pond scrubbing, supervision and running the ad-marking trailer, length frequency collection and reporting, assisting with CWT and PIT-tagging operations, and conducting tag and mark retention checks.

Hells Canyon steelhead were kept off feed for 31 days to slow growth rates, while Pahsimeroi steelhead were kept off feed for 48 days. Although early growth rates exceeded 0.033 inches per day, growth rates were slowed to 0.021 inches per day by taking the fish off feed for one week at a time.

A combination of Rangen and Moore-Clark fish foods were fed over the course of the year. A total of 462,540 lbs of Rangen and 11,000 lbs of Moore-Clark were fed (Appendix 5).

The Rangen feed total includes 51,330 lbs of OTC-medicated feed used for the single medicated feed treatment during this brood year. Oxytetracycline was fed allowing for a 21-day withdrawal time prior to stocking, meeting Food and Drug Administration (FDA) requirements.

The total cost of the OTC feed was $22,959.90. The total cost of regular feed was $129,993.52. A total of 459,580 lbs of fish were produced on 473,540 lbs of feed for a conversion rate of 1.03:1. Total NSFH production costs incurred by IPC during the 2000 brood year were $821,545.12, which includes IPC overhead, smolt hauling, and shop expenditures, but does not include capital outlay expenditures. The cost/lb of fish produced was $1.79.

Fin quality was assessed in April and May using methods developed by Chapman (1991). Fins of steelhead reared at NSFH were compared to fins of wild rainbow trout collected from the Henrys Fork of the Snake River. A total of 100 steelhead from all three of the PIT-tagged raceways were analyzed for fin degradation. After measuring the lengths of the dorsal and pectoral fins, a fork length was taken from each fish. By comparing the average fin length to the average fork length, it was determined that fins from fish raised at NSFH were 63.3% of wild fish fins (Appendix 6). This was only a 0.3% improvement from the 1999 releases and a 9.95% increase from the 1997 releases at NSFH.

Length frequencies (fork length) were taken prior to shipping (April and May) to track fish size and condition factors (Appendix 7). Length and weight data collected just prior to release is for National Marine Fisheries Service (NMFS). A target guideline of 170 to 250 mm was set by NMFS biologists to maximize migration and minimize predation by hatchery steelhead on wild salmon. The average length of the fish at release for three raceways in April and May was 201.4 mm (7.93 inches).

Fish Distribution

The IPC contracted with Neil Ring Trucking of Buhl, Idaho, to transport steelhead smolts to release sites using two IPC tank trailers. Transport of steelhead from NSFH began on March 26 and ended on May 9, 2001. Ninety (90) loads of steelhead (449,730 lbs) were transported to the Snake and Salmon rivers (Appendix 4). The first fish were transported to Hells Canyon, then the Little Salmon River at Stinky Springs (Oxbow stock), Pahsimeroi River below the weir, and then back to the Lower Salmon River at Stinky Springs (Pahsimeroi stock). Department biologists feel that Pahsimeroi fish do better if stocked after the second week in April.

Steelhead smolt release figures are as follows; Snake River at Hells Canyon Dam (Oxbow stock): 579,467 fish (124,550 lbs at 4.65 fish/lb); Little Salmon at Stinky Springs (Oxbow stock): 267,079 fish (59,200 lbs at 4.51 fish/lb); Pahsimeroi River below the weir (Pahsimeroi stock): 889,955 fish (219,230 lbs at 4.06 fish/lb); and the Little Salmon at Stinky Springs (Pahsimeroi stock): 194,303 fish (46,750 lbs at 4.16 fish/lb).

Total survival to release was 94.87% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 97.35%. Average survival to release for smolts and excess steelhead was 95.92%. Total NSFH production for the year was 459,580 lbs, or 2,361,937 fish.

In addition to steelhead released as part of normal production, a total of 431,133 steelhead fingerlings (9,850 lbs at 43.8 fish/lb) were released into Cascade, Paddock, Salmon Falls, Mormon, and Magic reservoirs between October 16 and November 1, 2000 (Appendix 11). These fingerlings were considered excess after the fin-clipping operations were concluded and final inventories had been placed into all raceways. Department personnel from HSFH transported all NSFH excess steelhead production for this brood year.

FISH HEALTH

Fish health is always a concern at NSFH. The location of NSFH, in the heart of the commercial trout industry, makes it vulnerable to the horizontal transmission of many etiologic agents. Disease problems from Infectious Hematopoietic Necrosis Virus (IHNV), Infectious Hematopoietic Pancreatic Necrosis Virus (IPNV), bacterial furunculosis *Aeromonas salmonicida*, and bacterial coldwater disease (CWD) have caused significant losses in years past (Munson, 1996). In addition, the NSFH and its spring (water source) are located directly below agricultural land, exposing both to toxic drift and runoff from chemical application to fields above the NSFH. Stringent sanitation programs are implemented to facilitate disease control.

Because furunculosis has been a problem in recent years, all the fish were vaccinated with an autogenous *Aeromonas salmonicida* bacterin from Aqua Health Limited. Fish were dipped in an oxygenated solution of 18 liters of water to 2 liters of vaccine with a one-percent (1%) salt solution incorporated into the vaccination solution. The salt solution was introduced to the vaccination protocol to reduce stress brought about by physical handling during vaccination and to increase the uptake of vaccine by the fish. Vaccine was applied at a rate of 220 lbs of fish per liter of vaccine, for 30 seconds. The vaccination program started on August 11 and ended on September 19, 2000. Average fish size at the time of vaccination was 87.39 fish/lb.

The vaccination program for enteric redmouth disease, *Yersinia ruckerii,* was not implemented during this brood year. Failure to detect this disease in pathological examinations over the last several years was the deciding factor in discontinuing this program

Mortality for the year was well below normal. *Flavobacterium* and *Aeromonas* caused minor mortalities just prior to release and a medicated feed treatment of OTC was administered. Fish were treated for 10 days with 4% OTC incorporated into the feed in accordance with FDA Investigational New Animal Drug (INAD) #9332 requirements. After the medicated feed treatments, mortality returned to normal levels.

The organosomatic index showed normal and above-normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was taken on both stocks of steelhead at NSFH, and all parameter levels for serum protein, leukocrit, and hematocrit were excellent. CTL and KTL were not assayed for this brood year. The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was excellent.

Furunculosis, IHNV, and ERM were not isolated at this facility during the 2000 brood year. An aggressive disease management program at this facility has been effective in controlling mortality due to these etiological agents. Stress leading to opportunistic bacterial infections may be due to population densities. In the future, management of steelhead inventory at this facility will be the key to managing disease-related mortalities (Munson 2000).

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose (AD) fin clip. Adipose fin clipping is done so that anglers can differentiate between hatchery and wild steelhead. The clipping process also gives the NSFH staff an accurate inventory, since all fish are counted during clipping. Steelhead were clipped at NSFH between October 2 and October 26, 2000.

Brood year 2000 steelhead were coded-wire-tagged (CWT) from September 16 to September 20, 2000. A total of 205,445 steelhead were CWT (137,343 Hells Canyon stock, and 68,102 Pahsimeroi stock). Each tag group is held in an individual raceway section so that separate mortality information can be gathered. The CWT groups of 30,000 fish were given a 100-ft section, while CWT groups of 60,000 fish were given 200-ft of rearing space.

A total of 184,805 CWT fish were released at three release sites (Appendix 8). A total of 62,729 CWT fish were released in the Snake River at Hells Canyon Dam between March 26 and April 7, 2001, while 61,384 CWT fish were released at the Pahsimeroi weir (Pahsimeroi River) between April 14 and May 5, 2001. A total of 60,692 CWT fish were released in the Little Salmon River at Stinky Springs from April 8 through April 12 and from May 6 through May 9, 2001.

In addition to the CWT fish, 900 fish were tagged with Passive Integrated Transponders (PIT) tags on February 26, 2000 (raceways 4, 8, and 12) (Appendix 9). These computer chips are injected into the body cavities of the fish and information can be accessed as to hatchery origin, length, weight, release watershed, date of release, downstream migration, timing, and travel rates. In this manner, an individual fish can be tracked on its seaward migration without sacrificing the fish. A total of three mortalities occurred after the tagging was completed. A total of 299 PIT-tagged fish were released at Hells Canyon, while 299 PIT-tagged fish were released in the Little Salmon River at Stinky Springs. In addition, 299 PIT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River).

SPAWN TIMING MANIPULATIONS

When hatchery managers are given an egg request by their supervisors, the natural tendency is to collect eggs from early-spawning fish and quit spawning when the egg request has been met, thus selecting out a portion of the spawning population. Over many generations of selecting for early-spawning fish, spawn timing could feasibly move forward. Historical records from Oxbow and Pahsimeroi hatcheries show steelhead spawning throughout May. Currently, hatchery females are spawned as late as possible, but spawning operations are usually finished by early May.

Current fish feed technology and ingredients allow hatchery managers to raise fish to smolt size much faster than in earlier years. In fact, most steelhead smolts reared in southern Idaho are held off feed during the production year so they don't get too large. At times, holding fish off feed for extended periods of time can be detrimental to fish health. Consequently, hatchery managers currently prefer eggs taken from later-spawning females.

In an effort to begin moving the spawn timing back to historical spawning times, the Department consulted University of Idaho geneticist, Dr. Madison Powell for recommendations. Dr. Powell suggested that 10% of early-spawning steelhead and 100% of late-spawning steelhead be spawned if Department personnel desire to move the spawn timing back without impacting the existing program. Department personnel at Oxbow and Pahsimeroi hatcheries attempted to employ these recommendations this year (Appendix 12) and will continue to do so in future years.

RECOMMENDATIONS

Completed Improvements

Several hatchery construction projects were completed this past year. A deck was constructed east of residence 2, and a new hose rack was constructed to hold and transport the 8-inch shipping hoses. A new countertop and shelves were installed over the incubator room sinks and new shelves were installed in the east incubator room. A pipe rack was constructed for the pickup truck and new shelves were built to store garden hoses. All three blower motors were rebuilt and the bypass valve from the blowers to the roof was repaired.

New aluminum dam boards were purchased for the outdoor raceways. A garbage dumpster was rented for hatchery and residential use. Miscellaneous tools were purchased for the shop at NSFH. A new Dodge truck was purchased through the Department's new Fleet Management Program (FMP) to replace the leased truck that was returned at lease end.

Capital outlay money was used to purchase a new pressure washer, a small freezer for fish mortalities, and a digital camera. A new fax machine and printer were also purchased to replace those broken machines in the office.

Several landscaping projects were also completed this past year. Numerous deciduous trees were planted around the hatchery and the park. Numerous sprinkler heads were replaced with larger heads for better lawn coverage. A new garden was created behind residence 2, and all gardens were lined with railroad ties for easier mowing and trimming. Redwood stain was applied to all the parking barriers in the park. Fencing was installed around all the new trees planted in the park to prevent porcupine damage. Weeds were sprayed in the spring and fall, and fertilizer was applied to all the grounds and park in the spring. Wildflowers were planted along the border of the adjacent property line with Rimview.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least twelve times its present size would adequately accommodate early rearing systems. The number of raceways should be based on optimum density indices needed to rear fish to a larger size (200 fish/lb or 2.5 inches

in length) before moving them to outside raceways. Using these criteria, there should be at least 15,120 cf of rearing space to ensure adequate rearing for fry. This system would protect fry from bird predation and provide them with shade from the sun.

Fry from Oxbow Hatchery are transported back to NSFH in a 2-ton truck borrowed from HSFH. This practice will probably continue until Pahsimeroi Hatchery obtains a disease-free water source for early incubation of steelhead eggs. Therefore, a 2-ton fish transport truck should be purchased to reduce disease transmission from a borrowed truck. The HSFH truck is thoroughly disinfected prior to use, but disease contamination is still possible by using it.

Twelve new 10-ft head screens need to be built. The existing 10-ft screens are currently used in the odd raceways as tail screens, and later moved to the even raceways to be used as head screens. Additional screens would allow personnel to keep the screens in the even raceways permanently and utilize the new ones at 75-ft and 150-ft as the fish grow. This will allow better flexibility and manipulation of fish populations and densities that do not exist with current raceway keyways.

Final Rearing

At least one more smolt-hauling truck and trailer are needed to ensure that smolts are released in a timely manner. Current hauling procedures require up to 45 days to haul fish to their respective release sites. Optimum release timing for smolts to minimize residualism and maximize downstream survival should involve fewer than half the 45 hauling days we are currently using.

At least six more raceway tail screens need to be built to replace the old screens now being used for clipping and coded-wire tagging. Additional screens are required so hatchery personnel can move existing screens without losing fish into the settling ponds. Also, additional CWT projects cannot be attempted without more screens if the fish are to be separated from the other fish in the raceway.

Employee Safety

A “trash-rack” needs to be installed in front of the intake gate at the upper pool to prevent access to the spring and injury to the public. A trash rack should also be installed at the entrance to the discharge canal to the Rimview Hatchery.

The bulk tank, conveyor line, and entrance gates to the outdoor raceways need to be raised. This is a safety issue as the low height of the conveyor line and gate doorways have caused numerous bumps and bruises.

Water Source

The water collection box, which supplies water to the incubator rooms, is located near the top of the spring and the amount collected is not enough to safely produce fry. Plans should

be developed to tap into the existing pipeline delivering water to the raceways or the hatchery head pool as a new supply source. For now, a degassing tower should be installed on the existing hatchery building pipeline because of the possibility of nitrogen gas toxicity. The line will hold 1,600 gpm of water, but only 1,200 gpm is useable because of nitrogen toxicity at 1,250 gpm.

Building Improvements

A new hatchery and incubation building with functional nursery raceways is badly needed. The building should also include public restrooms that are handicapped accessible, an office, shop, meeting room, and an adequate feed storage space.

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APPENDICES

Appendix 1. Niagara Springs Fish Hatchery Monthly Water Allocations

Month	Max. Flow	Month	Max. Flow
May	50 cfs	November	70 cfs
June	50 cfs	December	90 cfs
July	50 cfs	January	100 cfs
August	50 cfs	February	110 cfs
September	50 cfs	March	120 cfs
October	60 cfs	April	120 cfs

Appendix 2. Analysis of Niagara Springs Fish Hatchery Source Water

	Yearly Results						
Analysis	1994 (mg/l)	1997 (mg/l)	1998 (mg/l)	1999 (mg/l)	2000 (mg/l)	2001 (mg/l)	Maximum Contamination Levels
Alkalinity	166	195	160	140	170	180	10.0
Antimony	0.002	N/T*	N/T*	NT*	ND*	ND*	0.006
Arsenic	0.005	N/D*	N/D*	ND*	ND*	ND*	0.05
Barium	0.180	N/D*	N/D*	ND*	ND*	ND*	1.000
Beryllium	0.0002	N/T*	N/T*	NT*	NT*	NT*	0.004
Cadmium	0.00034	N/D*	N/D*	ND*	ND*	ND*	0.004
Chromium	0.002	N/D*	N/D*	ND*	ND*	ND*	0.1
Chloride	N/T	46	48	47	46	44	250
Copper	0.010	N/D*	N/D*	ND*	ND*	ND*	1.3
Cyanide	0.005	N/T*	N/T*	NT*	NT*	NT*	0.200
Fluoride	0.570	N/D*	N/D*	0.5	0.6	0.7	4.0
Hardness	234	270	230	230	230	230	100
Iron	0.010	N/D*	N/D*	ND*	ND*	ND*	0.3
Lead	0.002	N/D*	N/D*	ND*	ND*	ND*	0.015
Manganese	N/T	N/D*	N/D*	ND*	ND*	ND*	0.05
Mercury	0.0002	N/D*	N/D*	ND*	ND*	ND*	0.002
Nickel	0.003	N/D*	N/D*	ND*	ND*	ND*	0.1
Nitrate as N	1.630	1.9	1.9	1.8	1.6	1.7	10
Nitrite as N	0.01	N/D*	N/D*	ND*	ND*	ND*	1.0
PH	8.00	8.1	8.3	8.2	8.4	8.2	6.5 - 8.5
Selenium	0.005	N/D*	N/D*	ND*	ND*	ND*	0.05

*N/D = Not detected
*N/T = Not tested

Appendix 3. Niagara Springs Fish Hatchery Steelhead Survival from Egg to Smolt

Source	Eggs Received	Fry Received	Total Received	Fingerlings Released	% Survival Fingerlings	Smolts Released	Total Release	% Survival To Release
Pahsimeroi	758,656	657,786	1,416,442	259,548	*96.29%	1,084,258	1,343,806	94.87%
Oxbow	527,641	518,184	1,045,825	171,585	*98.14 %	846,546	1,018,131	97.35%
Totals	**1,286,297**	**1,175,970**	**2,462,267**	**431,133**	***97.22%**	**1,930,804**	**2,361,937**	**95.92%**

*Estimated percentages

Appendix 4. Niagara Springs Fish Hatchery Steelhead Smolt Distribution

Destination		Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	(Snake R.)	H.C.	124,550	3/26-4/7/01	4.65	579,467
Stinky Springs	(Little Salmon R.)	H.C.	59,200	4/8-4/12/01	4.51	267,079
Pahsimeroi	(Pahsimeroi R.)	Pah.	219,230	4/14-5/5/01	4.06	889,955
Stinky Springs	(Little Salmon R.)	Pah.	46,750	5/6-5/9/01	4.16	194,303
Total			**449,730**		**4.29**	**1,930,804**

Appendix 5. Niagara Springs Fish Hatchery Production Costs

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
2,361,937	473,540	$152,953.42	459,580	1.03	*$821,545.12	*$347.82	*$1.79

*Cost includes IPC cost for overhead, smolt hauling and shop expenditures and does not include capital outlay expenditures.

Appendix 6. Fin Lengths of Niagara Springs Fish Hatchery Steelhead, April and May 2001

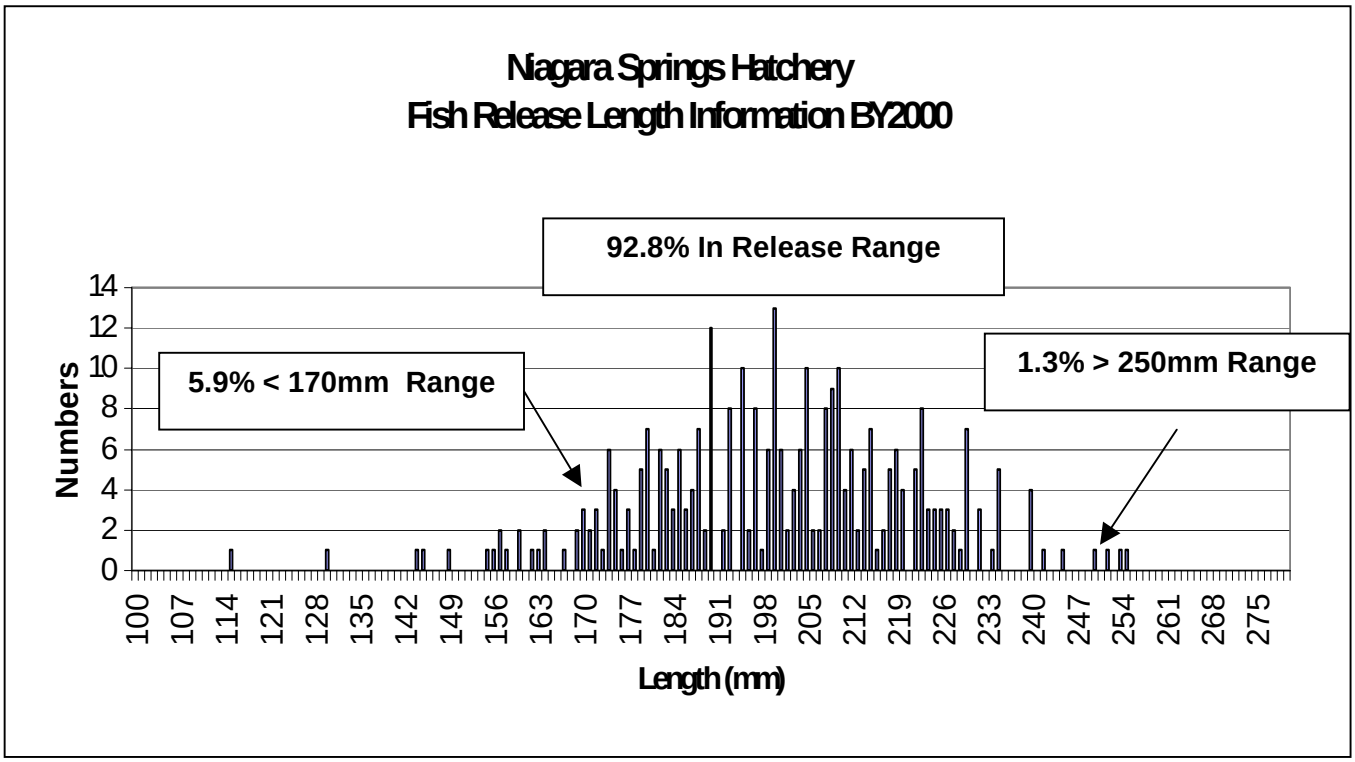
Average of 20 fish groups

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Factor
4	203	20	17	11	16	61
8	209	20	19	11	17	61
12	212	20	16	11	19	68
Average	**208**	**20**	**17**	**11**	**17**	**63**

Appendix 7. Length Frequencies (Fork) at Release for Three PIT-tagged Raceways, April and May 2001

Raceway #	H.C. 4	H.C. 8	Pah 12
Sample Size	100	100	100
Ave. Length	203	209	212
Lower Range (mm)	149	115	130
Upper Range (mm)	242	250	255

	(mm)	(inches)
Hells Canyon Average Length	196.1	7.72
Pahsimeroi Average Length	206.7	8.13
Overall Average Length	**201.4**	**7.92**



Appendix 8. CWT Summary for Steelhead at Niagara Springs Fish Hatchery

Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	Number Untagged	Total Tagged Group Release	Total Site Release
	Snake River								
2	Hells Canyon Dam	10-48-31	11,392	88	262	11,042	73,847		
		10-48-07	22,907	182	530	22,195			
Total-2			**34,299**	**270**	**792**	**33,237**	**73,847**	**33,237**	
	Snake River								
4	Hells Canyon Dam	10-48-32	11,486	88	1,529	9,869	68,706		
		10-48-08	22,834	172	3,039	19,623			
Total-4			**34,320**	**260**	**4,568**	**29,492**	**68,706**	**29,492**	**579,467**
	L. Salmon R								
8	Stinky Springs	10-48-37	34,207	260	3,736	30,211	40,101		
8	Stinky Springs	10-48-38	34,517	262	3,774	30,481			
Total-8			**68,724**	**522**	**7,510**	**60,692**	**40,101**	**60,692**	**461,382**
	Pah. River								
12	Pahsimeroi Trap	10-48-33	11,196	116	1,009	10,071	74,663		
12	Pahsimeroi Trap	10-48-09	22,871	238	2,059	20,574			
Total-12			**34,067**	**354**	**3,068**	**30,645**	**74,663**	**30,645**	
	Pah. River								
16	Pahsimeroi Trap	10-48-17	22,859	384	1,828	20,647	71,477		
16	Pahsimeroi Trap	10-48-30	11,176	189	895	10,092			
Total-16			**34,035**	**573**	**2,723**	**30,739**	**71,477**	**30,739**	**889,955**

Total CWT Release	**184,805**
Total Site Releases	**1,930,804**
Total Smolt Releases	**1,930,804**

Appendix 9. PIT Tag Summary for Steelhead at Niagara Springs Fish Hatchery

Raceway	Release Site	Number Tagged	Number Released	Mortality
4	Hells Canyon Dam Snake River	300	299	1
8	Stinky Springs Little Salmon River	300	299	1
12	Pahsimeroi Weir Pahsimeroi River	300	299	1
Totals		**900**	**897**	**3**

Appendix 10. Niagara Springs Fish Hatchery History, BY66 to Present.

NIAGARA SPRINGS HATCHERY
HATCHERY HISTORY BY66-PRESENT

YEAR	PAHSIM. Eggs/fry Received	OXBOW Eggs/fry Received	TOTAL Eggs/fry Received	TOTAL Yearly MORT.	% MORT Yearly	FALL Releases	Salmon R. SMOLT Release	Hells C. SMOLT Release	SPRING Releases	TOTAL LBS Released	Feed fed Total	Conv.	Fish/lb
1965-66	0	3,085,194	3,085,194	---	---	---	---	---	---	---	---	---	---
1966-67	0	2,605,288	2,605,288	623,533	23.93	29,400	1,364,842	587,513	1,952,355	153,552	305,890	1.99	12.71
1967-68	0	3,215,652	3,215,652	1,209,183	37.60	0	1,664,325	342,144	2,006,469	204,251	298,450	1.46	9.82
1968-69	0	2,469,536	2,469,536	695,219	28.15	0	1,665,117	109,200	1,774,317	184,186	280,430	1.52	9.63
1969-70	1,477,695	1,927,727	3,405,422	654,022	19.21	757,500	1,608,000	385,900	1,993,900	299,235	502,410	1.68	6.66
1970-71	1,330,494	1,480,150	2,810,644	-305,176	-10.86	670,960	1,630,002	0	2,444,860	202,025	384,040	1.90	12.10
1971-72	1,439,842	700,061	2,139,903	153,603	7.18	215,625	1,555,050	0	1,770,675	235,375	376,080	1.60	7.52
1972-73	8,850,764	1,819,721	10,670,485	3,105,637	29.10	3,008,664	1,543,349	0	4,556,184	163,839	266,800	1.63	27.81
1973-74	3,663,990	1,264,384	4,928,374	2,953,847	59.94	0	1,960,378	0	1,974,527	187,494	319,130	1.70	10.53
1974-75	3,160,144	280,098	3,440,242	2,108,426	61.29	0	1,331,280	0	1,331,816	166,640	352,890	2.12	7.99
1975-76	2,234,978	51,559	2,286,537	513,688	22.47	40,977	1,690,390	0	1,731,872	248,708	437,600	1.76	6.96
1976-77	2,487,824	730,862	3,218,686	1,642,383	51.03	0	1,433,675	141,005	1,576,303	251,835	454,762	1.81	6.26
1977-78	2,540,728	517,250	3,057,978	1,229,537	40.21	281,208	1,266,025	0	1,547,233	154,829	370,080	2.39	9.99
1978-79	2,048,350	441,069	2,489,419	426,977	17.15	344,944	1,372,454	0	1,717,498	244,887	643,680	2.63	7.01
1979-80	2,622,425	124,814	2,747,239	203,985	7.43	548,987	1,097,060	348,220	1,994,267	314,100	629,580	2.00	6.35
1980-81	1,697,010	498,416	2,195,426	720,172	32.80	0	862,494	612,760	1,475,254	316,330	622,930	1.97	4.66
1981-82	2,003,418	298,952	2,302,370	953,015	41.39	0	995,205	354,150	1,349,355	374,350	663,850	1.77	3.60
1982-83	2,313,339	253,776	2,567,115	1,431,975	55.78	500,000	542,390	92,750	635,140	181,150	448,860	2.48	3.51
1983-84	2,749,292	709,716	3,459,008	1,849,313	53.46	449,070	752,195	408,430	1,160,625	310,000	632,400	2.04	3.74
1984-85	2,333,760	598,404	2,932,164	613,771	20.93	630,500	1,273,181	414,712	1,687,893	314,650	541,198	1.72	5.36
1985-86	1,332,152	1,582,340	2,914,492	903,999	31.02	330,640	860,358	819,495	1,679,853	339,885	580,850	1.71	4.94
1986-87	1,339,176	935,195	2,274,371	422,476	18.58	39,995	1,011,900	800,000	1,811,900	419,000	557,960	1.33	4.32
1987-88	1,640,040	1,289,029	2,929,069	775,569	26.48	404,000	872,100	877,400	1,749,500	405,515	584,290	1.44	4.31
1988-89	1,256,289	1,213,399	2,469,688	803,488	32.53	0	930,700	735,500	1,666,200	406,800	574,770	1.41	4.10
1989-90	1,925,795	833,397	2,759,192	252,892	9.17	603,000	956,100	947,200	1,903,300	465,400	597,310	1.25	4.09
1990-91	1,966,434	113,190	2,079,624	311,624	14.98	0	856,000	912,000	1,768,000	484,025	632,030	1.28	3.65
1991-92	650,400	691,500	1,341,900	311,400	23.21	0	786,600	243,900	1,030,500	232,500	283,000	1.22	4.43
		812,000	812,00	394,936	48.64	0		417,064	417,064	72,786			5.73
	Wallowa												
1992-93	1,131,951	1,013,846	2,145,797				761,800	353,600		235,075			
1992-93	Babington		*Babington	Release	In Little	Salmon	*222,560	306,907	**47,089	131,090			
			**Brownlee	Reservoir									
1993-94	954,294	1,509,596	2,463,890	1,263,820	54.89	0	928,981	609,115	1,538,096	350,151	440,143	1.26	4.40
1994-95	1,042,728	1,099,915	2,142,643	281,034	13	160,000	741,180	960,429	1,701,609	376,060	489,960	1.29	4.52
1995-96	1,400,000	1,397,103	2,797,103	906,008	32.4	157,600	890,135	843,360	1,733,495	352,750	429,528	1.22	5.00
1996-97	1,297,250	1,303,599	2,600,849	698,156	26.84	149,040	1,093,002	660,651	1,753,653	370,520	421,144	1.14	4.79
1997-98	1,434,497	1,211,977	2,646,474	992,649	37.5	0	942,430	711,395	1,653,825	361,745	412,624	1.14	4.57
1998-99	1,412,000	1,393,383	2,805,383	759,809	27.08	60,634	1,185,535	657,665	1,843,200	444,455	484,110	1.09	4.63
1999-00	1,712,675	1,133,871	2,846,546	281,131	9.87	364,923	1,011,633	792,902	2,295,605	457,626	469,043	1.02	4.30
2000-01	1,416,442	1,045,825	2,462,267	100,330	4.07	431,133	1,351,337	579,467	1,930,804	459,580	473,540	1.03	4.29

Appendix 11. Stocked BY2000 Steelhead from Niagara Springs Fish Hatchery

Date	Treatment (Stock/Transfer)	Location	Stock (fpp)	Size (lbs)	Number (#)	Number
10/16/00	Stocked	Cascade Reservoir	HC	56.5	2,725.0	154,015
10/17/00	Stocked	Paddock Reservoir	HC	50.2	350.0	17,570
10/23/00	Stocked	Salmon Falls Reservoir	Pah.	37.6	3,200.0	120,205
10/30/00	Stocked	Mormon Reservoir	Pah.	28.6	1,800.0	51,480
10/31/00	Stocked	Magic Reservoir	Pah.	49.5	1,025.0	50,738
11/01/00	Stocked	Magic Reservoir	Pah.	49.5	750.0	37,125
TOTALS				**43.8**	**9,850.0**	**431,133**

Appendix 12. Oxbow and Pahsimeroi Stock Spawn Timing Manipulations at NSFH for BY2000

Oxbow Stock Eggs Used for Production Purposes			**Pahsimeroi Stock Eggs Used for Production Purposes**		
Lot Number	Spawn Date	Percentage Utilized for Smolt Production	Lot Number	Spawn Date	Percentage Utilized for Smolt Production
A	03/16/00	0%	1	03/13/00	0%
B	03/20/00	51%	2	03/16/00	0%
C	03/24/00	51%	3	03/20/00	47%
D	03/27/00	25%	4	03/23/00	47%
E	03/30/00	6%	5	03/27/00	47%
F	04/03/00	6%	6	03/30/00	47%
G	04/06/00	100%	7	04/03/00	54%
H	04/10/00	100%	8	04/04/00	54%
I	04/13/00	100%	9	04/06/00	0%
J	04/17/00	100%	10	04/07/00	21%
K	04/20/00	100%	11	04/10/00	21%
L	04/24/00	100%	12	04/11/00	69%
			13	04/13/00	69%
			14	04/17/00	100%
			15	04/20/00	100%
			16	04/24/00	100%
			17	04/27/00	100%
			18	05/11/00	100%

Submitted by:

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Jerry Chapman
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Approved by:

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Virgil K. Moore, Chief
Fisheries Bureau

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Tom Rogers
Fish Hatcheries Supervisor